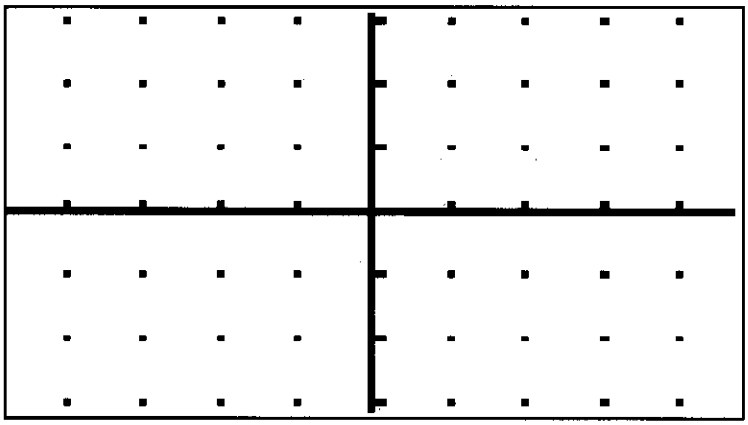
Example #2. Let **f(t) = 2t - 2**. Sketch the graph of **f** on [-2,4]



Let $A(x) = \int_0^x (2t - 2)\,dt$

Using your graph of **f**, answer the following questions and sketch the graph of **A**.
(Remember: The **y-value** of a point (x,y) of function **A** represents the **area** in the graph of **f** from t = 0 to t = x)

Questions:

a. What is A(0)? _____

b. What is A(1)? _____

c. What is A(2)? _____

d. What is A(3)? _____

e. What is A(-1)? _____

f. What is A(-2)? _____

g. Where does A reach its minimum value? _____

h. What happens to A as $x \to \infty$? _____

i. What happens to A as $x \to -\infty$? _____

Plot the coordinates of the points found in parts a-f in the same window as the sketch of the graph of f(t).

Sketch what you think A(x) might look like.

3. Verify your sketch by graphing A(x) using **fnInt(2x - 2, x, 0, x)** on your calculator.

4. "Guess" the equation for the function y = A(x) that you sketched in question 2 and graphed in question 3. A(x) = _____

5. Use Part I of **The Fundamental Theorem** to analytically derive the actual function.

6. Is the answer to question 5 the same as your answer to question 4?

Answer the following questions about the relationship between the function f(t) and

$$A(x) = \int_a^x f(t)\,dt$$

1. What is the value of **A(a)** ? _____

2. A **maximum** or **minimum value** of **A(x)** occurs at a _____ of **f**?

C. Fundamental Theorem, Part II

Conjecture: What is $\frac{d}{dx}\left(\int_a^x f(t)\,dt\right)$?

a. Write $\int_a^x f(t)\,dt$ in symbolic form.

b. Take the derivative the answer in (a) *with respect to x.*

1. $\frac{d}{dx}\left(\int_2^x \sqrt{2+\cos t}\,dt\right)$

2. $\frac{d}{dx}\left(\int_2^{x^2} \sqrt{5+t^3}\,dt\right)$

3. $\frac{d}{dx}\left(\int_{x^2+x}^{\sin x} \sqrt[3]{t+t^4}\,dt\right)$

4. Evaluate $\frac{d}{dx}\left(\int_{x^2}^{x+2x^3} \sqrt{t}\tan t\,dt\right)$ at x = 1